

FILE  
K-20  
CAME  
SECRET

6 May 1955

FOR THE RECORD.

1. Question - How many camera could or should be taken?

Answer - Four (4) aerial camera are deemed to be sufficient for balloon overflight photography. Two (2) modified K-20's with 6-3/8 inch lens, and two modified K-20's with 15 inch lens.

a. These cameras are paired as units, the 6-3/8 inch lens is used for vertical photography and the 15 inch lens for obliques.

b. The other pair or unit can be considered as spares as a safeguard during transportation or other unforeseeable mishap.

2. Question - What type of camera or cameras should be utilized?

Answer - Four (4) modified K-20's, two with 8-3/8 inch lens, these two (2) cameras hold a roll of film 5-1/2 inches wide and twenty (20) feet long, making a total of fifty (50) pictures.

a. The two (2) cameras with the 8-3/8 inch lens have the following additions built into the camera and record automatically on the film by means of an electrical and optical system the hour, minute, second, day, month, date, altitude, temperature and the horizon with forward view and after view. This is obtained by two (2) mirrors mounted with an optical system which is at an angle of 45 degrees to the 6-3/8 inch photographic lens.

3. Question - Will the camera be compact enough to be operated in the confined area of a balloon gondola?

Answer - Yes

Question - Is a camera bracket or swivel mount possible?

Answer - Yes

Question - Would an opening in the basket floor be practical for vertical exposures?

Answer - Yes

4. Question - Will the camera require a power supply to operate the camera?

Answer - Yes and No. The changing of film after each exposure is accomplished by hand by pushing a lever forward and returning it, this hand operation places new film in position and also actuates a series of electrical switches that are synchronized to the camera trigger. When the camera trigger is pressed to make the picture, several small flash light bulbs flash against mirrors which reflect the instruments readings thru an optical system. The record is photographed at the instant the photo is made on the four inch side of negative. Four (4) small mercury cell batteries supply the power. If the ambient temperature is fifteen (15) degrees below zero (F.) the film no doubt will crack and shatter, also the springs in the camera may break. Cameras operating in temperatures near and below freezing should be heated internally to guarantee proper functioning.

5. Question - Will the shutter/trigger operation be simple enough to be operated by the gloved hands of the operator?

Answer - Yes

6. Will night photography or photography in poor light be possible?

Answer - Night photography is possible by dropping large <sup>F</sup>lash bombs. The Air Force have such a system, but in the above discussion using a balloon it does not appear to be practical.

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Photography in poor light is possible by using Tri-~~B~~<sup>X</sup> film and it is possible to get a readable negative prior and after sun-up and sundown.

7. Question - What filters are required and will they be so modified as to provide ease of adjustment and removal?

Answer - Two (2) filters are provided. One (1) Minus Blue which is a yellow filter for light haze. The other is a 25A which is a red filter for a thick or heavy haze.

There is no adjustment to make with either filter except to increase the exposure time. If the normal exposure is 250<sup>th</sup> second, F 16 without a filter, increase the exposure to F. 11 with the Minus Blue filter and with the 25A filter increase the exposure to F 5.6. Both filters are easily snapped on or off the lens.

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8. Question - What means could be employed by the operator to overcome clouds, haze and poor photography over the target area?

Answer - Regarding clouds, there is no means for the operator to penetrate clouds or fog. Regarding haze, the operator should be able to determine with his eyes which filter to use. A simple rule is - if he can see the target and distinguish objects on the ground through a small amount of haze use the Minus Blue or Yellow filter. If he has difficulty in distinguishing objects through a heavy haze use the 25A or Red filter.

9. Question - What type of film will be utilized?

Answer - Two (2) types: Super XX Aerographic, and Tri-X

If the operator plans on going over the target at dawn or dusk or during the very early morning or late afternoon he should load the cameras with Tri-X. If he plans on any time between two (2) hours after daybreak and two hours before dusk he should load his camera with Super XX Aerographic.

10. Question - What photogrammetry gimmicks should be utilized to achieve stereo effect, the proper overlap, measurable tilt, indicate drift, etc.?

Answer - A standard aerial photographic view finder, designed for the proper size camera format, is all that is necessary for assuring proper stereo-overlap.

To assure good tilt determination, with the 15" camera, the following procedure is recommended:

It is unlikely that the horizon will be exposed on the format of an oblique photo due to the narrow cone angle. Therefore, the photographer should note an object imaged near the top of his viewfinder as he exposes his photo. Then, he should expose another, this time placing the object near the bottom of the viewfinder. This procedure should be repeated until the horizon is imaged in the viewfinder. The remittant series of photos will enable the photogrammetrist to reconstruct the successive depressions angle and thereby determine the spacial geometry of the desired photo, for measurement purposes.

Drift (it is supposed that this is analogous to "crab") is no particular problem, provided that the camera is kept oriented with the side of the photographic format parallel to the direction of movement of the craft.

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11. Question - What information is required in order to compile an adequate photo flight log?

Answer - The flight log is almost an unnecessary item, photographically speaking, with the instrument recording in the film.

Additionally, the following should be recorded:

- f-stop numbers used
- Shutter speeds
- Film type and speed
- Altimeter correction factors, if any used
- Filter types used
- Type of time recorded on clock. (GCT, LCT, etc.)
- Impressions of photographer regarding weather and lighting conditions during photographic run
- Record of any difficulties or malfunctions experienced, keyed in by time for comparison with photographic results

12. Question - What waterproofing, moisture proofing, or insulation of the camera will be necessary?

Answer - As for water and moisture proofing, the camera - None.

As for insulation - if the weather is extremely cold an electrically heated pad over the working parts which transports the film is a good precaution to prevent film shattering and camera failure. A decrease of  $3\frac{1}{2}^{\circ}$  temp. for each 1,000 ft. alt - subtract this from ground temp. for approx. temp at desired

13. Question - What type and how much training will be required to qualify the balloon pilot photographer?

Answer - In view of the fact that the entire mission is designed to obtain photographs of the target and that only certain cameras, films and filters will be used, it would only be necessary to thoroughly train him with this equipment only and not attempt to confuse him by discussions on optics, chemistry, color, etc.

Five (5) days is considered enough time to train the average person in how to read light meters, understand different speeds of film, how to determine what filter to use and adjust the iris of the lens to compensate for the filter. How to take precaution against finger prints on lens or filter, how to load - unload and operate camera, and the precautions necessary in handling unexposed and exposed film.

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14. Question - What would be the total weight allowance for photographic equipment for photography at 5,000 ft., 10,000 ft., 15,000 ft., 20,000 ft.?

Answer - The photographic equipment necessary to accomplish photography at altitudes ranging from 5,000 ft. to 20,000 ft. would be the same in all instances. The only significant difference in the photography would be the smaller scales resulting from higher altitudes. At 20,000 ft. the photo-scale is one-fourth that of 5,000 ft. altitude.

If it is determined that insulation or heating of the camera equipment is necessary at 20,000 ft., depending upon meteorological studies, and not at 5,000 ft., and the craft will fly at 20,000 ft. during the photographic run, then this is an item whose weight should be considered for the higher altitudes.

Other than this possible supplemental item of insulation or heating of the gear, no additional photographic equipment is necessary at increased altitudes.

15. Question - How precise must the photography be? Should it satisfy strict photogrammetry specifications?

Answer - For all indicated uses of the photography which will be accomplished on the mission, the proposed camera installation should provide the precision necessary. The instrumentation and the photography should provide sufficient data for reconnaissance type measurement and interpretation.

The cameras to be used are not precision cameras, nor are they designed to yield cartographic-quality photography. They were designed to furnish rapid, adequate, photographic results when properly used.

It is believed that the cameras selected for this particular project will quite adequately perform the task required of them.

Comment:

Good books on air temperatures--

"Weather and Climate" by Glenn T. Trewartha, 1954

"The Song of The Sky" by Guy Murchie, 1955



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